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AUTHOR Bourgeois, M.; Ashcroft, S. C.
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ABSTRACT

The study involving three blind elementary school, six blind high school, and four blind college students was designed to establish oral reading rates and oral reading error rates for Ss reading conventional braille volumes and brailled materials with the Digi-cassette, an electronic braille reading and writing machine. Data suggested several points: (1) reading with the Digi-cassette is slower than reading conventional braille; (2) the similarity in reading error rates between the two reading modes suggests that the mechanical features of the Digi-cassette and the problem of "broken" words at the end of a line, are not causing significant numbers of errors to occur; and (3) low oral reading rates with the Digi-cassette may be accounted for by lack of experience with the instrument, by modification in personal reading style, or by increased memory load for past words or letters due to the nature of the 12-cell braille line. (SBH)

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Paperless Braille Reading:
A Preliminary Research Report

M. Bourgeois, Research Associate
S. C. Ashcroft, Professor

George Peabody College for Teachers
Nashville, Tennessee

Paper presented at
The 57th Convention of
The Council for Exceptional Children
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Paperless Braille Reading:
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M. Bourgeois, Research Associate
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Electronic and computer technology is beginning to make a larger and more pervasive impact on the education of visually impaired children than ever before. Instruments such as the Optacon, the Kurzweil Reading Machine, and paperless braille equipment should have a far-reaching and profound effect on these children. As educators, however, we have a duty and responsibility to these and future blind children to insure that the quality, practicality and reliability of new equipment that becomes available is not merely adequate, but that these devices will have a positive and beneficial effect on the educational performance of these children.

Fortunately, federal funding agencies are aware of the need to carefully evaluate new technological developments. This is a report on one such evaluation project funded by BEH, Division of Media Services; entitled "Evaluation and Research Program for the Portable Braille Recorder (or Digi-cassette)." While purposes of this project include 1) field testing the Digi-cassette in order to establish its potential as an educational aid for blind children, 2) determining user satisfaction, practicality, reliability, and maintainability of the Digi-cassette, and 3) studying braille

reading and writing performance with the Digi-cassette, this paper discusses the preliminary data collected on reading performance with the Digi-cassette.

The Digi-cassette is an electronic braille reading and writing machine, that uses audio cassettes instead of paper to store information.

(figure 1)

The user can prepare a text using the standard braille keyboard and later read it back on this 12-cell or a 20-cell display. When reading a text, the user simply turns on the machine and presses the transfer button to advance the tape. When information in braille appears, the first 12 cells of the text pop up out of the display. The user can then read them and when finished, simply touch the touch switch to read the next 12 cells. In this manner, the user can control the rate at which he reads the braille cells. Theoretically, this machine has the potential of alleviating the imbalance in supply and demand for conventional braille volumes, to say nothing of the cost reduction and space-saving features of audio cassettes as opposed to braille books.

However, several of the Digi-cassette's unique features warrant investigation. The most obviously different features of this equipment are the 12-cell braille reading line, and the touch switch. These two factors often require major changes in braille readers' reading habits. For example, while it is not unusual for the blind child to use the three middle fingers of both hands to read a braille volume, the

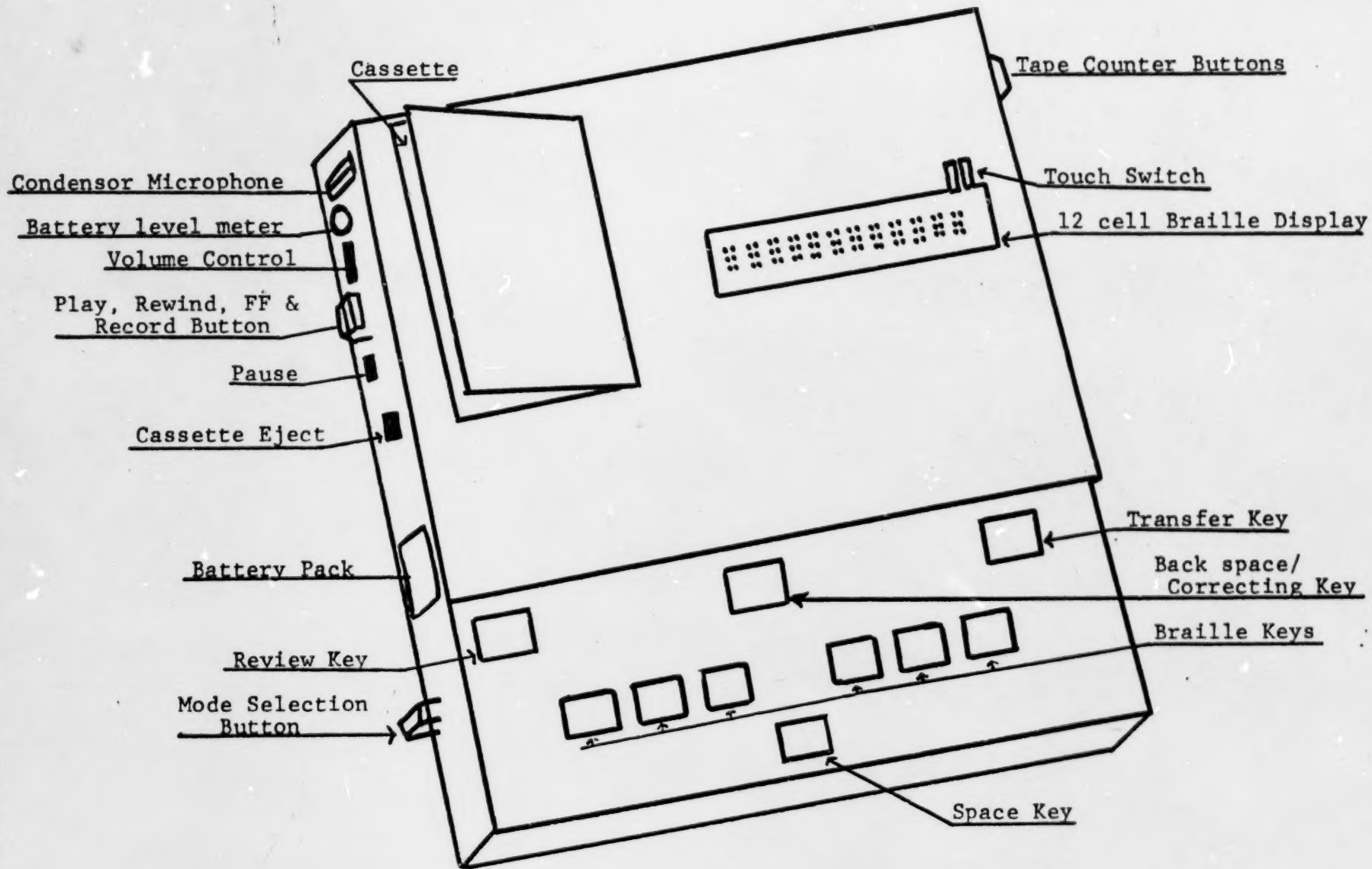


Figure 1. Digi-cassette Schematic

the same child has to limit himself to one, or at best, two index fingers when reading the Digi-cassette. This in part, is due to the sensitive nature of the touch switch, which is a simple circuit requiring only the slightest touch of a finger to be completed and to change the line of braille.

The 12-cell display can also cause problems for the reader. For example, when a word does not fit in entirety within the 12 cells, the word is broken indiscriminately at the letter filling the 12th braille cell, and the remainder of the word's letters appear on the next line. No hyphens appear when this occurs. As a result, the probability of reading errors increases. An isolated "s" symbol in the 12th cell is easily read as so, whereas it could just as likely be the first letter of the word "sailor."

Therefore, it is of interest to know how well students can read braille using the Digi-cassette when they are required to adapt to a 12-cell reading line and to a sensitive touch switch. It is also of interest to discover whether or not the students' reading errors will increase as a result of using the Digi-cassette. The purpose of the following study was to establish oral reading rates and oral reading error rates for subjects reading conventional braille volumes and brailled materials with the Digi-cassette. Statistical treatment and graphical representation of the data will demonstrate trends in student performance. Comparisons of reading rate and reading error rate performance in two reading modes (conventional braille vs. braille on Digi-cassette) will be made.

Method

Subjects

Presently Digi-cassettes have been placed with three blind elementary school children in local day schools, six high school students from the residential school for the blind, and four blind college students at George Peabody College. These participants were chosen on the basis of their desire to learn to use this equipment for note-taking in their classes; all participants were braille readers. Each elementary and high school aged participant received an average of four hours of orientation and instruction with a staff member, after which a criterion-referenced proficiency test was administered. A score of 90% or better on this test insured that the child had mastered the operations of the Digi-cassette.

College students required no more than one hour of orientation and instruction to become proficient in operating the Digi-cassette.

Procedures

Data collection activities proceeded in the following manner. During four 1 hour sessions in which subjects were instructed in the operations of the Digi-cassette, five minute audio-recordings were made of the subjects reading from novel junior/senior high school level reading materials in braille. A word per minute score for each session was calculated for each subject by taking the mean of the five 1-minutes samples.

A criterion referenced proficiency test was administered to each subject during the fourth session. A score of 90% or better insured that the subject could operate the Digi-cassette and could successfully troubleshoot equipment malfunctions.

After obtaining a 90% score or better score on the criterion-referenced test, oral reading rates were established using the Digi-cassette and pre-recorded braille cassettes during weekly assessment sessions. The mean of five 1-minute timed intervals was calculated for a word per minute score. Oral reading was tape recorded and later transcribed in order to establish reading rates and reading error rates. Reading error rates for each subject were calculated from the reading samples. A reading error was defined as any incorrect repetition, self-correction, incorrect word, or unread continuous portions of the text. The reading materials used were novel junior high graded reading passages, such as Island of the Blue Dolphin and Little Women.

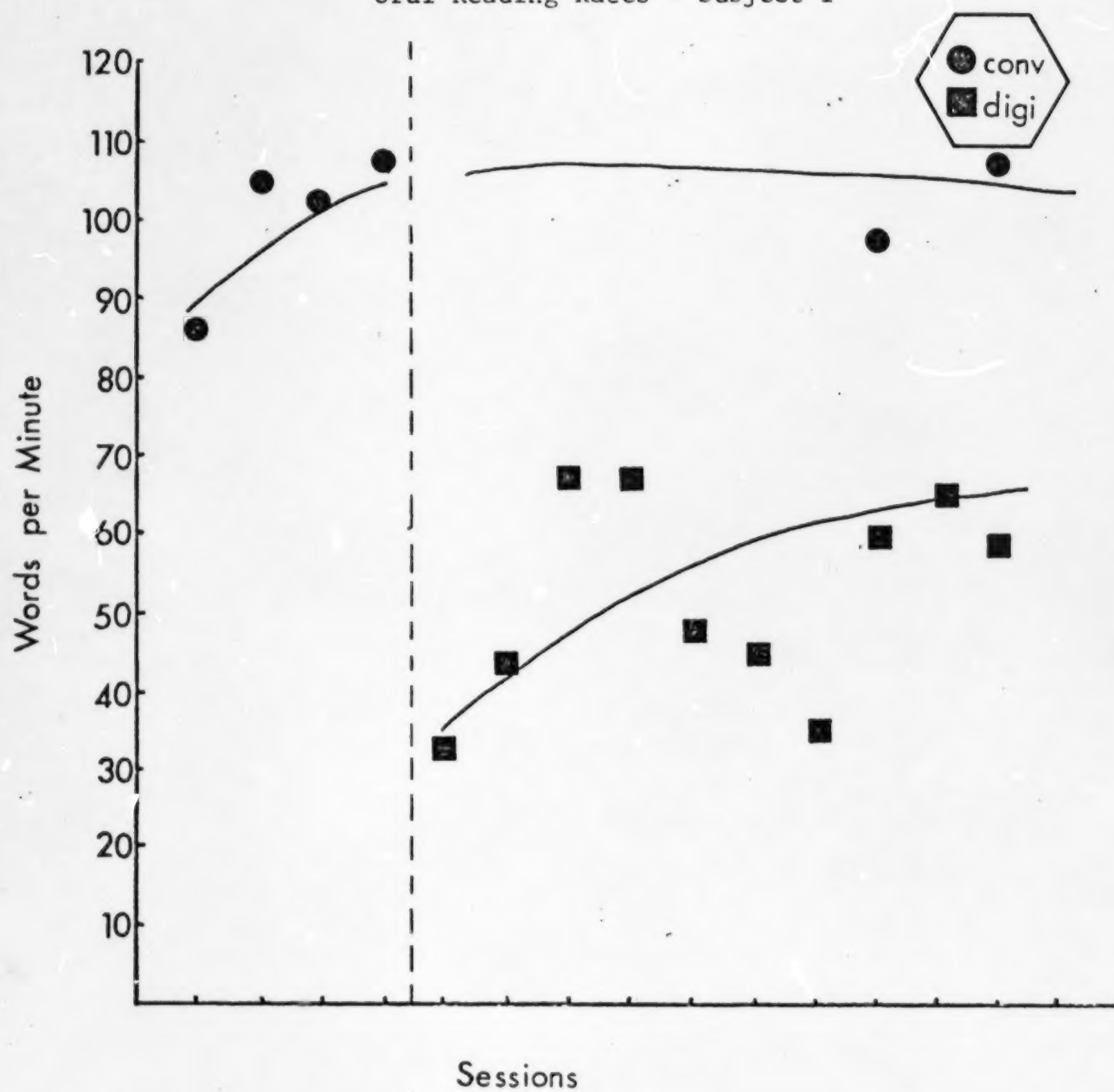
Subjects contracted with the staff for the length of time they served as participants. After their contracts had expired, each student was asked to answer detailed questionnaires about the Digi-cassette's functions and their own satisfaction with it.

(figure 2)

Results

Figure 2 is a graph of subject 1's reading performance with conventional braille books (conv. - circles) and with

Figure 2
Oral Reading Rates - Subject 1

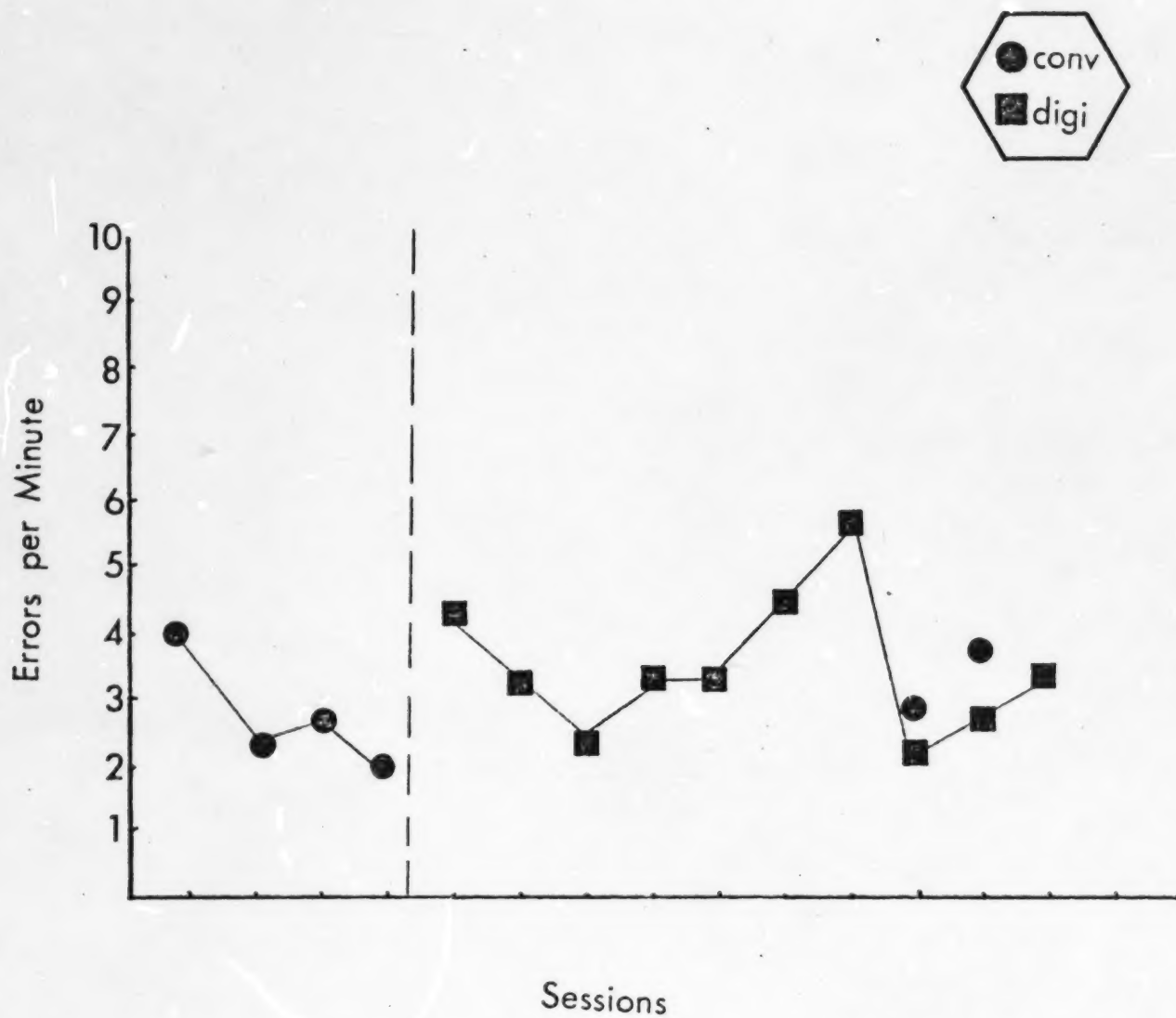


Digi-cassette braille tapes (digi- squares). The first four data points represent the number of words per minute read with conventional braille during the instructional (or baseline) period. The dashed line represents administration of the criterion-referenced proficiency test. Squares represent word per minute scores for oral reading with the Digi-cassette. Notice that subject 1's oral reading rate with the Digi-cassette (approximately 60 wpm) is consistently slower than his reading rate with conventional braille (approximately 105 wpm). The positive trend in the Digi-cassette reading rate scores would lead one to predict insignificant differences between reading rates in the two reading modes in time.

Figure 3 represents the reading error rate for the two reading modes. Again, circles represent the mean of five 1-minute conventional braille reading samples and the squares represent Digi-cassette reading samples. Notice the similarity in reading error rates between the two modes: with conventional braille the range of errors per minute is 2 to 4 and with Digi-cassette braille the range is 2 to 5.5 errors per minute.

Because the six high school subjects demonstrated results similar to those of subject 1, the data for these seven subjects were grouped. Figure 4 represents the preliminary grouped data for oral reading rates. As shown in Figure 2, reading rates with conventional braille are consistently

Figure 3
Oral Reading Error Rates - Subject 1



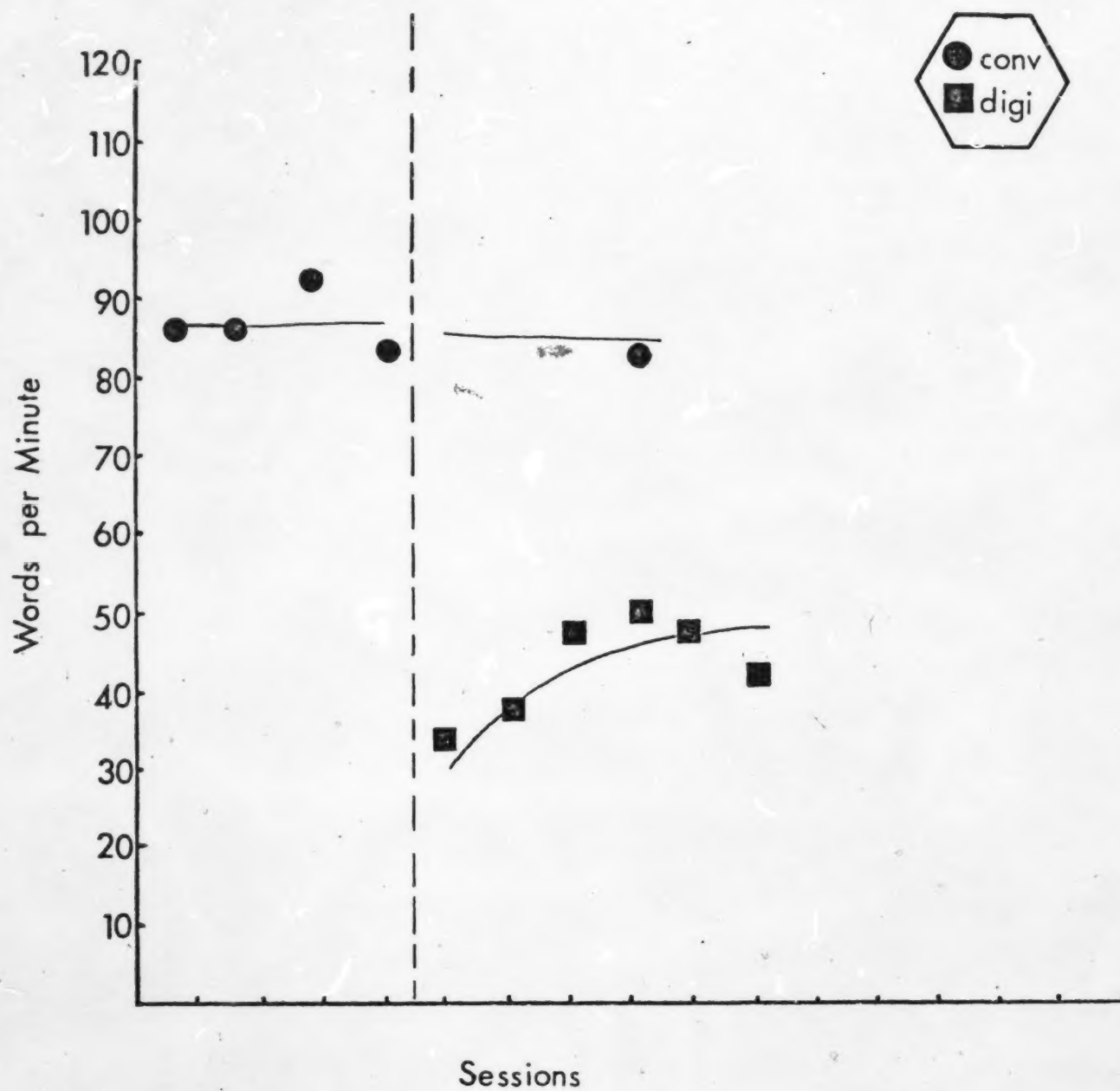


Figure 4
Oral REading Rates: Group Data, N=7

faster (approximately 90 wpm) than reading rates with the Digi-cassette (approximately 50 wpm). The oral reading performance with the Digi-cassette, as shown in Figure 4, demonstrates a positive trend. However, the considerable difference in performance between conventional braille reading and braille reading with the Digi-cassette suggests the need for improving braille reading with the Digi-cassette.

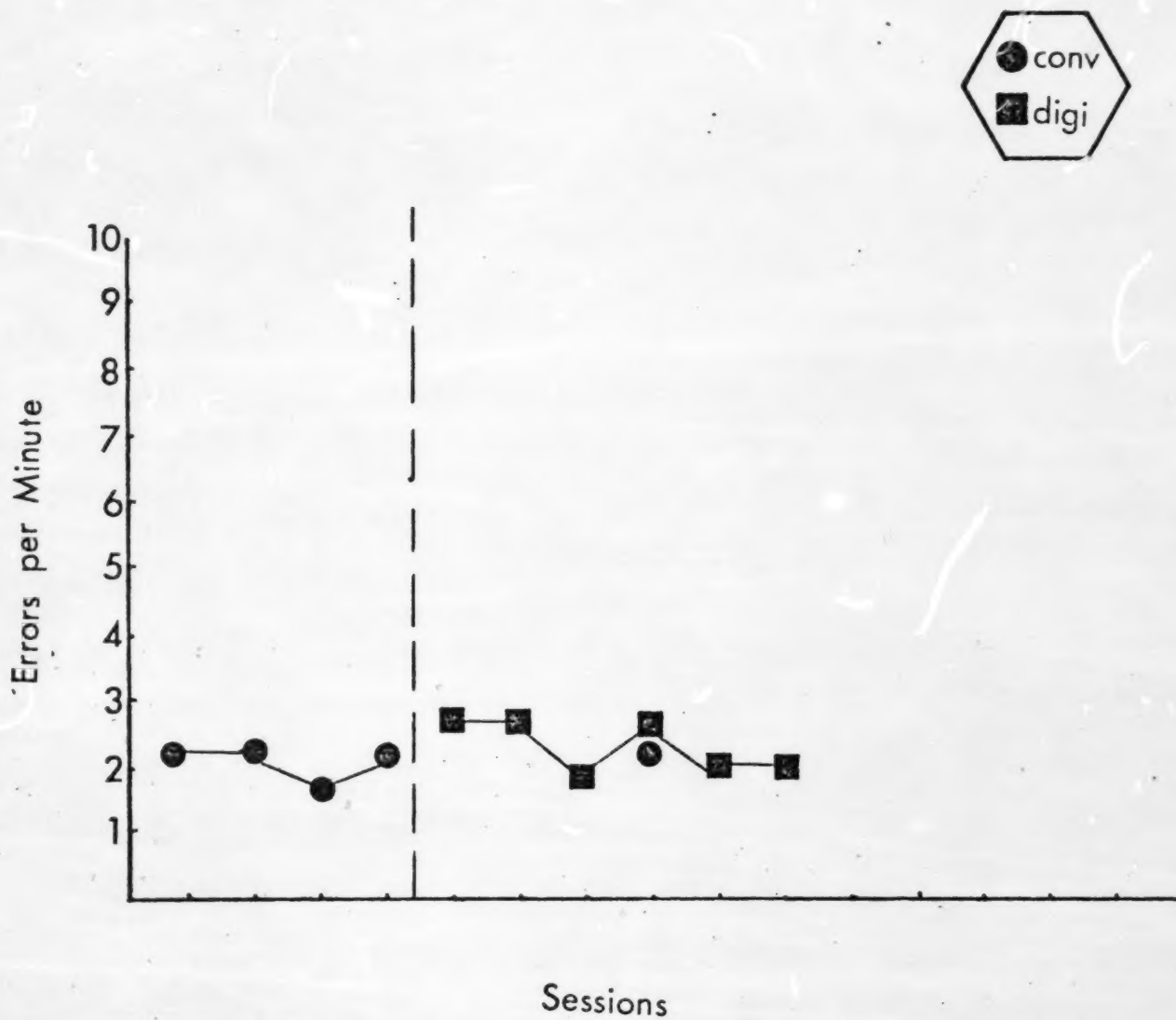
Figure 5 represents the oral reading error rate grouped data for the two reading modes. Again, notice the similarity in error rate performance between the two reading modes. The range in error rate for conventional reading is 1.8 - 2.4 errors per minute, while the range for reading with the Digi-cassette is 1.8 - 2.9 errors per minute. Although statistical tests have not yet been run, significant differences are not anticipated to be established.

Discussion

These data suggest several points:

1. Reading with the Digi-cassette is slower than reading conventional braille. Subjects consistently read 30-50 wpm slower when reading with the Digi-cassette.
2. The similarity in reading error rates between the two reading modes suggests that the mechanical features of the Digi-cassette and the problem of "broken" words at the end of a line, are not causing significant numbers of errors to occur. Because of the nature of the Digi-cassette, subjects may be slowing down their reading rate, as demonstrated by their reading rate performance, in order to compensate for the

Figure 5
Oral Reading Error Rates: Grouped Data, N=7



adjustments made in their reading style due to the Digi-cassette. As a result of their slower reading rate, subjects may be committing fewer actual reading errors, yet enough machine handling error for the total number of errors to be similar to the errors committed when reading conventional braille. Reading transcripts need to be examined further to categorize the actual types of errors committed in reading.

3. Low oral reading rates with the Digi-cassette may be accounted for 1) by lack of experience with the Digi-cassette (3 months for Digi-cassette vs. 8-10 years for conventional braille), 2) by modification in personal reading style (from coordinated two handed reading to one handed reading) or 3) by increased memory load for past words or letters due to the nature of the 12-cell braille line. Further research is needed to test these hypotheses.

This study was designed to establish the differences in oral reading rates between the two reading modes when subjects received only informal instruction in reading the 12-cell display. Perhaps a reading program could be developed which would improve reading rate scores for a 12-cell braille line.

In conclusion, the data reported today are only preliminary data. Further compilation of data and statistical treatment of the data are necessary before a definitive statement of the results can be suggested. It is hoped that other researchers and educators will use this research model to collect performance data for students using equipment such as the Digi-cassette, Versabrilie, Optacon and others.

These data will then be useful in the modification of equipment and in the design of educational programs which will be bnenfical to visually impaired students.